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November 1989

Center for the Study of Reading

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UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
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Abstract

This report addresses the nature of the knowledge people possess about word meanings, and how this knowledge is acquired and used in reading comprehension. A "standard model" of word meanings is outlined, which equates word meanings with criterial features, or necessary and sufficient conditions for serious, literal use of a word. This model underlies both current common sense thinking about word meanings and much of current pedagogical practice in vocabulary instruction. Arguments against various aspects of the standard model by linguists, philosophers, and psychologists are reviewed. Although many points are still being debated, it is concluded that the current consensus of scholars can be best characterized as the rejection of the standard model.

WORD MEANINGS

> Words have often been called slippery customers, and many scholars have been distressed by their tendency to shift their meanings and slide out from under any simple definition. A goal of some clear thinkers has been to use words in more precise ways. But though this is an excellent and necessary step for technical jargon, it is a self-defeating program when applied to ordinary words. It is not only that words are shifters; the objects to which they must be applied shift with even greater rapidity. (Labov, 1973, p. 341)

This report addresses the nature of the knowledge people possess about word meanings, and how this knowledge is acquired and used in reading comprehension. Drawing on philosophy, linguistics, and psychology as well as education, this report attempts to describe gaps in knowledge and controversies as well as to marshal the reasoning and evidence for what can be accepted as truths. Although we have incorporated some original thinking of our own, and have been contentious about some issues, our fundamental purpose has been to present a state-of-the-art synthesis.

Some Basic Distinctions

As Labov said in the passage quoted above, words, and in particular, their meanings, are "slippery customers." Words about word meanings are no exception; if anything, they have proved more slippery than most. In a field as old as the study of word meanings, it should come as no surprise that the words used to talk about meanings themselves have many meanings. Thus, no discussion of word meaning can proceed fruitfully without a definition of terms. We will use *meaning* as an everyday, pretheoretical term, and *sense, reference, connotation*, and *denotation* as technical vocabulary. We would not care to say that all of these terms are needed to adequately characterize word meanings. They are needed, though, to talk about the distinctions maintained by philosophers, linguists, and others who theorize about semantics.

We will define the *reference* of a word as the thing or things "picked out" by the word on a particular occasion for use as, for instance, the word *dog* in the sentence, *The black dog looks mean*, in a situation in which there are several dogs, one of which is black. Of course, the words in two or more utterances have the same reference if they pick out the same thing.

This occasion-specific use of the term reference is now fairly common (cf. Lyons, 1977), but it must be distinguished from an older and even more common use to mean all of the things a word might stand for; in this usage *dog* would be said to refer to all dogs. To maintain a distinction between specific and general reference, we will use the traditional term *denotation* to indicate the entire class of entities associated with a word. (An alternate term for the entire class that we could have chosen is *extension*.) Of course, the reference and the denotation of a word can be identical, as in *I'm not afraid of dogs*.

The construct *denotation* applies most felicitously to concrete nouns; for example, the denotation of *apple* is the set of all apples. The construct is extended by analogy to other types of words; for example, the denotation of *red* can be defined as the set of all red objects; the denotation of *migrate* as the set of all instances of migrating. The denotation of a word is the set of all potential referents for a word, imaginary as well as real. Thus, we take the position that the denotations of *unicorn* and *griffin* are different, even though both sets happen to be empty in the known universe.

Notice that a person's internal representation of the denotation of a word could not be just a list of members in the set, because the denotations of most words are indenumerable. How, for instance, could apples from next year's crop be listed? Instead, what people must have in their heads is some basis for determining membership in the set. We will use the traditional term *connotation* (we could have used *intention*) for the distinctions, or rule, for deciding whether an object, action, or property belongs to the set that constitutes the denotation of a word. (This use of connotation should not be confused with the everyday meaning of affective coloration.)

We will define the *sense* of a word as the distinctions the word conveys in a particular circumstance of use. A more common usage is to equate sense with connotation as we have just defined it; that is, as

the distinctions which it is supposed are conveyed on any and all circumstances in which the word is used in a serious, literal-minded fashion.

The four terms we have introduced are related according to the paradigm below:

Language Function	One Occasion	All Occasions
Pointing	reference	denotation
Attributing	sense	connotation

Sense and reference are context-bound whereas denotation and connotation are context-free. Ordinarily, but not always, the reference of a word is included within its denotation. The sense and the connotation of a word are related but, if we are right, they are seldom identical.

Although all four of these concepts may not be necessary for a satisfactory characterization of word meaning, either the sense/reference distinction or, alternately, the connotation/denotation distinction is required. The distinction is necessary to account for the fact that two expressions can refer to the same individual or object, and yet clearly be different in meaning. In a classic paper, Frege (1892; translation, 1966) made the case for the distinction using the sentence *The morning star is the evening star*. Of course, the referent of the two expressions is the same; both refer to the planet Venus. Yet the meaning--more precisely the sense--is different; one is about a heavenly body visible in the morning, the other about a heavenly body visible in the evening. Hence, the sentence is [potentially] informative instead of being tautological and, hence, uninformative. For another example, compare *triangle* and *closed three-sided figure*. The two expressions denote the same geometric figures. But *triangle* brings to mind angularity whereas *closed three-sided figure* highlights, promotes, or calls attention to the feature of sidedness. Contrasts such as these demonstrate that the distinction between sense and reference is a real one, and contribute to the case that both concepts are necessary to adequately represent word meanings.

Meanings of Different Types of Words

Any reasonable theory of word meaning has to take into account the fact that there are fundamentally different types of words. An obvious distinction is that between function words and content words. Whatever sort of meanings one wants to attribute to the words *if* and *the* will be different in nature from the meanings of words like *ostrich* or *panic*. Likewise, words like *Hello* and *Gesundheit*, to the extent that they could be said to have meaning, have meaning of a quite different sort.

We adopted as a basic definition of the connotation of a word the distinctions, or rule, for deciding whether an object, action, or property is a member of the class of objects, actions, or properties that constitutes the denotation of the word. However, this definition requires some refinement, in order to deal with problems posed by different types of words.

Proper names are a case where some refinement is needed. On the one hand, proper names are used generatively; seen from different distances, from different angles, or on different occasions, even the same individual does not look exactly the same. In that sense, one has some sort of strategy or rule for recognizing an individual.

On the other hand, whatever means people may have for recognizing an individual, these do not constitute the meaning or sense, of that individual's name. Traditionally, therefore, proper names have been said to have reference, but not sense. They refer to specific individuals, but the reference is by convention, not by rule.

One way to clarify what constitutes the connotation of a word has been on the basis of necessity. That is, the connotation of a word is taken as the set of necessary and sufficient conditions for inclusion in the denotation. This provides a basis for the claim that proper names do not have sense. For example, your friends may recognize you on the basis of the size of your nose, the color of your hair, and the presence or absence of a mustache; but changing any or all of these would not change your name. More generally, no particular fact about you is necessarily true; therefore, no such fact can be considered part of the meaning--that is, the connotation--of your name.

On the same basis, it can be argued that there are other categories of words which do not have connotation, as we have defined it. In particular, Kripke (1972) and others have argued that this is true of natural kind terms. For example, the word *dog* denotes, by convention, a particular species of animal. There are various ways we can distinguish dogs from other species of animals, but none of these are the meaning, or connotation, of the word *dog*. Changes in the breeding of cats and woodchucks might result in a world in which the only reliable test for doghood was careful chemical testing of chromosomes; but the meaning of the word *dog* would not therefore come to be defined in terms of such a test. The word *dog* simply denotes, by convention, a particular kind of being; the nature of that kind of being, and the tests used to distinguish that kind from others, are part of our knowledge of the world, but not part of the meaning of the word.

Green (1984) argues that what has been claimed about natural kind terms applies as well to many other types of words, so that most words should not be considered to have connotation, as we have defined it. However, Green does not extend this claim to all words in the language; she agrees that there are some words which refer, not simply by convention, but by describing.

It is clear that phrases can refer by describing rather than by convention. For example, someone can refer to a given individual either by name (Grover Cleveland) or by a description (the only person to serve two non-consecutive terms as president of the United States). According to Green, some kinds of words, those which Putnam (1975) calls one-criterion words, also refer by describing, for example, *bachelor*, or *orphan*. In the case of *dog* or *gold*, it is reasonable to say that there is a certain kind of entity, conventionally denoted by a particular name, and that knowledge of particular facts about these kinds (e.g., that gold has a particular atomic weight, or that dogs are mammals) are knowledge of the world, not knowledge of the language. In the case of *orphan*, however, it cannot reasonably be said that there is a particular kind of individual, and that among the facts we happen to know about members of this kind is that they don't have living parents.

In summary, the point is that one cannot expect a simple, unified theory of word meaning to work for all types of words. As Putnam says, "To look for any one uniform link between word or thought and object is to look for the occult" (1975, p. 290).

The Standard Model of Word Meaning

The "standard model" of word meaning, briefly stated, equates word meaning with connotation, and defines connotation in terms of the necessary and sufficient conditions for inclusion in the denotation. A primary purpose in this report is to explore the properties of this model, then present a variety of arguments exposing its weaknesses and shortcomings.

It might seem that we are not only setting up a straw man, but beating a dead horse: It would be difficult to find anyone at present who would espouse the entire "standard model" as we will define it. However, we consider this mode of presentation worthwhile, for three reasons:

First, dissatisfaction with the standard model is perhaps the most accurate representation of the current consensus. That is, scholars concerned with word meanings concur in their rejection of aspects of the standard model, but not on any model to replace it.

Second, the horse is not dead, or, to switch figures, the straw man is still very seductive. To some extent, the standard model we define comes close to reflecting a "common sense" view of word meaning that forms the implicit basis for much of the thinking that is done about word meanings, especially in applied areas such as reading and vocabulary instruction.

Third, although it might be hard to find anyone who would hold to all the attributes of the standard model, for most of the individual attributes we will be able to find contemporary proponents.

We want to make it clear that we are looking for a psychologically real and pedagogically relevant model of word meanings; thus, the standards we set for a theory of word meaning are not necessarily those adopted by all of its proponents. Nevertheless, contemporary proponents of various aspects of the standard model include psycholinguists as well as philosophers, and, as we have said, whatever its origins, the standard model of word meaning continues to influence educational practice.

The core of the standard position is that word meanings can be characterized in terms of criterial features, that is, necessary and sufficient conditions for inclusion in the denotation of a word. This means, for example, that the ability to fly could not be part of the meaning of the word *bird,* because it is neither necessary nor sufficient; not all birds fly, and not everything that flies is a bird. The notion of criteriality follows from assumptions of abstractness and parsimony. These two interrelated properties are fundamental to the standard model of word meaning; we discuss them in turn in the following sections.

Abstractness

Learning word meanings entails more than acquiring names for a large number of individual persons, objects, actions, and qualities. Even the concrete object names that constitute a large proportion of children's first words are not names for individuals, but for classes of objects. The overgeneralizations sometimes observed in children's language, for instance, a child using the word *dog* for a cow, are interesting in the way that they may reflect differences between child and adult representations of word meanings. But they are also interesting in that they highlight a more basic property of word meanings. Knowing what a word means is somehow to know a generative rule, a rule that allows a person to map a given sequence of sounds or letters on to a potentially infinite but still restricted class of possible referents. Overgeneralization errors of the sort children make are not like mistakenly calling your friend Mike by the name John. Rather, they reflect the child's attempt to induce a rule.

Some level of abstractness, then, is necessary to account for the ability people have to apply words to novel instances, for example, to recognize an Irish setter as a dog, even though they may never have seen a dog of that variety before. What is in question is the degree and nature of the abstraction in the internal representation of word meanings. There are three ways that information about a word meaning could be stored in the mental lexicon:

1. Knowledge of a word's meaning is stored exclusively in the form of a rule or generalization defining the set of entities or events to which this word can be applied. No information about individual examples is stored permanently in the mental lexicon.

2. Knowledge of a word's meaning is stored exclusively in terms of a set of examples of the use of that word, along with the situations in which these examples are embedded. No rule is stored, but ordinarily one can be quickly derived from the examples when needed to interpret a new use of the word.

3. Knowledge of a word's meaning is stored both in terms of examples, and in terms of a rule, perhaps an incomplete one, that helps determine the set of possible uses of the word.

These three alternatives lead to somewhat different predictions about how people will process word meanings, and what sort of relationships among word meanings can be expected in the language. Of course, Alternative 1 is embodied in the standard model.

Parsimony

The level of abstraction postulated for word meanings depends in part on the extent to which parsimony of representation plays a role in one's theory of word meaning. The standard theory comes down on

the side of maximal parsimony; this is inherent in the equation of word meaning with a set of necessary and sufficient conditions.

The commitment to parsimony is a pretheoretical assumption that reflects a belief about what counts as an elegant theory. Parsimony has always been a criterion applied to scientific theories. Explicit formulation of this criterion goes back at least to William of Occam (1300-1349). It is an axiom of scientific inquiry that the broader the sweep of explanations the better, and that redundant, piecemeal explanations should be avoided. In other words, according to the criterion of parsimony, principles should be stated in the most general form allowed by the data.

However, there is no convincing a priori reason to assume that, in representing word meanings, the human mind avoids redundancy and strives for parsimony of representation. The question that we shall raise is whether the data on words and their meanings allows as much parsimony as the standard model supposes.

Context Variation in Word Meaning

The criterion of parsimony becomes problematical as soon as one tries to account for different meanings, or shades of meaning, that words display on different occasions. A number of psycholinguistic studies appear to show that the meaning of terms can vary according to context. For example, consider the meaning of the term *nurse* in the following two sentences:

Nurses have to be licensed.
Nurses can be beautiful.

The first sentence emphasizes the fact that a nurse is a health professional whereas the second emphasizes the femaleness of nurses. Anderson and Ortony (1975) obtained evidence of the psychological reality of this difference in emphasis. They found that *doctor* was a better cue for recall of the first sentence while *actress* was a better cue for the recall of the second.

Considering results such as the foregoing, Anderson, Pichert, Goetz, Schallert, Stevens, and Trollip (1976) propose that

> a word does not have *a* meaning, but has, rather a *family* of potential meanings. When comprehended in context, the meanings of the words in an utterance are further articulated in a process of inferential interpolation based on schemata which embody one's knowledge of the world. The effect with respect to nouns is usually to limit the scope of reference to a subset of the cases which would otherwise be denoted. If the context is rich and if the message is processed deeply, a noun may be identified with a single real or imagined thing. This process will be called *instantiation* . . . [A] close analysis will show that a word can have a somewhat different sense in each use. (p. 667)

Johnson-Laird and his colleagues (Tabossi & Johnson-Laird, 1980) have also found evidence for the psychological reality of context-based variation in meaning. However, Johnson-Laird (1981, 1983, 1987; see also Perfetti & McCutchen, 1986) has objected to the claim of Anderson and his colleagues that both the sense and reference of terms depend upon context. Johnson-Laird argues that except in the case of "genuinely polysemous words"--for instance, *bank*, which can mean a financial institution, the side of a river, or to tilt and turn an airplane--the sense of words remains fixed on every occasion of use, and only the reference changes.

Johnson-Laird's position is motivated by a desire to maintain parsimony in the representation of word meanings. He asserts this explicitly, when he says,

> In fact, there has been too much emphasis on polysemy and in consequence a mistaken view about the mechanism of instantiation . . . [T]he crucial psychological criterion is whether or not it is necessary to postulate more than one semantic representation for a word in order to account for the interpretations of the sentences in which it occurs. Instead of asking how many different

> meanings can be squeezed out of the word, psycholinguists need to ask what is the minimum number of different senses that are necessary to cope with all of its different uses. (p. 196)

Continuing, Johnson-Laird writes,

> If *eat* were truly polysemous then the sentence *He eats the food* should be highly ambiguous. It should have many wholly distinct senses. Yet it remains unequivocal. What is true, however, is that the sentence in common with others can be truthfully asserted of an infinite number of different situations: *he* can refer to any male individual; *food* can designate an indefinite number of different ways from chewing it like cud to straining through the teeth. This indeterminacy of reference is not sufficient to establish ambiguity because, if it were all open-class words would be infinitely ambiguous and their meanings could not be contained by a finite brain. Hence, the sentence above, which truly applies to a variety of situations, is referentially indeterminate, but not ambiguous. Its syntax is unambiguous and its words are unambiguous; they each have in ordinary usage a single sense, but these senses suffice, as do the senses of all words, to embrace many different situations. The sentence requires only a single representation of its meaning. (pp. 196-197)

Thus, Johnson-Laird's explanation for shifts in meanings of words is that the reference, but not the sense, of a word may vary from context to context. With respect to the sentences about nurses shown above, presumably Johnson-Laird would say that the set of nurses referred to in the first sentence is not identical to the set of nurses referred to in the second sentence. For instance, he might point out with regard to the second sentence that some nurses are male. Notice, though, that if one were to say about a male nurse, *That nurse certainly is beautiful*, it would not be for the purpose of drawing attention to his status as a health professional!

But rather than quibble over debatable cases, let us consider contexts in which the reference of certain terms is undeniably the same:

> *All the nurses at Massachusetts General Hospital are licensed.*
> *All the nurses at Massachusetts General Hospital are beautiful.*

These uses of *nurse* differ in sense even though the reference is identical.

One way to save the concept of fixed word connotation, and at the same time explain the rich interpretation usually made of words in context, is to distinguish sharply between linguistic knowledge and world knowledge. In this realization, connotation is pure linguistic meaning, or *core meaning*; it is the decontextualized and presumably invariant concept associated with a word. And sense (as we are using the term) is what might be called the *contextual meaning*; it is connotation, onto which are embroidered inferences based on the circumstances of use and relevant world knowledge.

Thus, it may be possible to postulate a single connotation or core meaning for *nurse*, and to account for the type of variation in the above examples in terms of some general principles for incorporating inferences based on world knowledge, that would also apply to analogous cases involving words like *secretary, receptionist, doctor, carpenter*, and so on. In some cases, then, a distinction between connotation, or core meaning, on the one hand, and sense, or contextual meaning, on the other, may make it possible to maintain a single parsimonious representation of word connotation, even in the face of what appears to be genuine contextual variation in meaning.

There are two rejoinders to this (apparently successful) attempt to preserve the parsimony of representations of word meaning. The first is to point out the steep price of parsimony. The notion of core linguistic meaning is now at least one more step removed from the data about meaning gathered in experiments like those of Anderson et al. (1976). As we will attempt to show in detail later, ultimately the notion of literal core meaning can only be maintained by divorcing this notion from phenomenological and experiential senses of "meaning."

The second response is that while distinguishing core meaning and contextual meaning may seem to work in the examples just discussed, it will not work in a large number of other cases. Consider the

problems that arise when one attempts to arrive at any fixed representation of the meaning of the verb *give*. The first connotation of this word listed in *Webster's Third New International Dictionary* (1964) is "to confer ownership of something without receiving a return." This definition works just fine with *John gave Mary a present*, but already there is a problem with *John gave Mary $10 and she gave him $2.57 change*. The putative fixed connotation fails to cope with the fact that "receiving a return" in goods or service, as well as a return of change, is expected in this context. The problem is even more acute in *John gave Mary a kiss*. *Gave* seems to be used here in a perfectly ordinary way, but does one really want to mean that John "conferred ownership" of a kiss?

Examine most entries in a large dictionary such as *Webster's Third New International* and you will see how unwieldy the concept of a fixed, context-free word connotation is. *Webster's* recognizes that *give* is, in Johnson-Laird's phrase, "genuinely polysemous" by according it two main entries. The secondary entry lists two related senses, (a) "tendency to yield to force" and (b) "state of being springy." The primary entry begins with "to confer ownership . . ." and continues with no less than 56 other related senses in 14 major groupings, as well as a number of idioms.

The issue of parsimony must be looked at in terms of degrees and types of relatedness among words. Everyone would agree that there are instances of homophony--for example, the three different meanings of *bank*--that must be described by postulating distinct connotations. Similarly, we would agree with Johnson-Laird that there are some instances of contextual variation in meaning that might be characterized in terms of a fixed core meaning, and principles of inference and instantiation that result in a more elaborated, context-specific sense. However, there remain cases of related meanings, such as the subentries listed under one of the main entries of *give*.

The principle of parsimony of representation, applied strictly, makes the following claim: Any two senses which are genuinely related (i.e., not instances of homophony) can be treated in terms of a single, more general, core meaning, and general principles of inference and instantiation that account for contextual variation in word meanings. We argue that this claim can be falsified in many specific cases. Not only that, but we argue that a broad look at the English lexicon shows that it is more characterized by redundancy than by parsimony, and that parsimony is at most a secondary consideration in determining the nature of semantic representations. Therefore, even when a parsimonious representation of word meaning in terms of a single core meaning is *possible*, such a representation generally is not the most psychologically realistic.

The Family Resemblance Model of Word Sense

It is instructive to consider some of the senses listed under the primary entry for *give* in *Webster's*: (3d) "to administer as a medicine," for example, *give her a shot of penicillin*; (4c) "to perform the action necessary or appropriate for a public performance or production," for example, *give a concert*; (6a) "to yield or furnish as a product, consequence, or effect," for example, *the candle gave its final flicker*; (8a) "to deliver or deal by some bodily action," for example, *give him a shove*; (9b) "to deliver verbally," for example, *give a warm greeting*; (10c) "to make known, or impart knowledge or information about," for example, *give a valid argument;* (12f) "to allow to have or take," for example, *give him permission*.

All of these senses of *give* are related, to be sure. What is not true, though, is that the senses are related because they embody a single fixed connotation, or core meaning. If the sense of the different uses of the term were identical, it would be possible to substitute the same synonym in each expression and preserve the meaning. However, you can say *set forth a valid argument*, but you cannot, in any normal situation, say *set forth a warm greeting*; you can say *grant him permission* but you cannot say *grant him a shove*.

Instead, the relationship among the senses of *give* in various contexts is better characterized as one of "family resemblance," to borrow Wittgenstein's (1953) insightful metaphor. In a human family there is a greater or lesser degree of resemblance among the members. The nature of the resemblance shifts from member to member, without there necessarily being any one clear respect in which all are alike. The same is true of the meanings of most words in actual use. The features that are important shift from use to use. A feature which is essential in one use may be unimportant or even absent in another.

We recognize that there are some cases in which a core meaning, plus general principles of inference and instantiation, *can* account for contextual variation in word meaning. As Johnson-Laird says, "All open-class words . . . are closer to being pronouns than is commonly recognized; they provide a relatively simple semantic framework that can be enriched by inferences based on knowledge. These inferences concern the situation designated by the sentence, and different linguistic contexts highlight different aspects of lexical meaning" (1987, p. 187).

However, we deny that it is possible to set up a "relatively simple semantic framework" to account for much of the variation in meaning represented by related senses found in dictionaries. A problem with stretching a single word sense to cover every related use is that the sense necessarily becomes increasingly abstract--that is to say, bland and vague. No meaning of *give* that is general enough to cover all the clearly related senses would account for the fact that you can give, but not grant, someone a shove. In general, the effect of stretching word senses to make them maximally inclusive is to cede any linguistic basis for explaining nuance. All richness and particularity of understanding is left to be explained in terms of knowledge of the world.

The proposal that word senses are fashioned to be maximally inclusive and parsimonious also leads to a psychologically implausible picture of vocabulary acquisition, in that learning new senses of a word would have to diminish the amount of information in one's lexical representations. Say, for example, a person knew the word *deliver* only in the sense of delivering mail. If that person then learns the senses of *deliver* for delivering babies, and delivering speeches, his or her knowledge of the word *deliver* becomes general to the point of being vacuous.

Furthermore, although a general core meaning might, with the help of general principles of inference and instantiation, account for the range of meanings that a word can take on, this approach will generally not account for *which* specific meanings a given word actually does and does not take on. Consider the dictionary entries for the word *gusset* and *gore* (entry #2) from *Webster's Third New International*, unabridged:

gusset:

1a: a piece of chain mail or plate at the openings of the joints in a suit of armor

1b: a usually triangular or diamond-shaped insert (as of cloth or leather) placed in a seam (as of a sleeve, pocketbook, glove) to give ease or expandability; also, a similar piece made by adding stitches at the heel of hose

1c: any V-shaped or triangular insert (as in a sail or skirt) as: (1) an elastic insert in a shoe upper (as for providing a snug fit) (2) gusset tongue: bellows tongue

1d: a pleat or fold esp. in bookbinding

2: something resembling a gusset, as:

2a: a gore of land

2b: (1) gusset plate: a connecting or reinforcing plate that joins the truss members in a truss joint or fits at a joint of a frame structure or set of braces, (2) gusset stay: a bracket or angular piece of iron for strengthening angles of a structure (as an airplane or a bridge)

3: a pretended abatement in heraldry consisting of either side of a pall without the top opening

gore:

1a: a small usually triangular piece of land

1b: a relatively small unassigned or disputed tract of land lying between larger political divisions (as townships)

1c: a minor unorganized and usually sparsely settled or uninhabited part of a county (as in Maine and Vermont)

2a: (1) a tapering or triangular piece of cloth (2) one of several flared lengthwise sections of a garment (as a skirt)

2b: gusset 1c

3a: one of the triangular pieces of the covering of a dome, umbrella, balloon, or similar object

3b: one of the series of related sections of a map that is applied to the surface of a sphere in the making of a terrestrial globe

4: a heraldic bearing imagined as two curved lines drawn respectively from the sinister or dexter chief and from the lowest point of the shield to meeting in the fess point

These two words illustrate the inadequacy of the construct of core meaning. There are obvious similarities among the meanings of *gusset* and *gore*, but no set of features in common to the meanings of each that would distinguish them from each other, or from a more general meaning such as "triangle." These two words show clearly that the family-resemblance pattern of related meanings is not restricted to high-frequency words like *give*.

Even if a core meaning could be constructed for each of these words, this core meaning could not predict which particular meanings each of these words has taken on. There may be some historical reasons why *gusset* took on some meanings and *gore* took on others, but as far as a description of present-day English is concerned, it is an arbitrary fact that these words have the specific meanings they do. Likewise, it is a historical accident, so to speak, that the webs in the feet of ducks and other water birds have not come to be called *gores* or *gussets*, or that *gore* did not take on the meaning of *shim*; these possible extensions seem no less reasonable than the ones that actually occurred.

Both high-frequency verbs like *give* and low-frequency nouns like *gore* and *gusset* have related meanings with a family resemblance structure that cannot be adequately characterized by means of a single core meaning. One can attempt to accommodate these cases in the standard model of word meaning by deviating from the strict position of parsimony, and allowing separate entries for related but distinct meanings; the difficulty is that there are no principled boundaries between uses involving the same sense, related but distinguishable senses, and wholly distinct senses. Anyway, wherever the lines are drawn, forcing different uses of words into categories will obliterate fine distinctions in sense to which people are sensitive.

Our claim is that *give, gore* and *gusset* are typical, rather than exceptional. What constitutes a normal situation for English vocabulary is an anomaly in the standard model of word meaning. The assumption of parsimony does not characterize the way word meanings are actually organized in human memory.

Accounting for Contextual Variation Within the Standard Model

There are several avenues by which one might try to maintain some version of a core meaning approach to the multiple senses one finds for a verb like *give*, as in the sentences,

John gave Frank five dollars.
John gave Mary a kiss.

The doctor gave the child an injection.
The orchestra gave a stunning performance.

The initial problem, of course, is to postulate a general meaning for *give* that would account for these four sentences. At first glance, this seems next to impossible, since the intersection of the four senses of *give* here seems close to empty. However, it is not logically necessary for core meanings to simply be the intersection of the features of all their contextual realizations. One can conceive of rules of contextual modification of meaning at change features as well as rules that add them. Such a rule would, in effect, provide an algorithm for answering the question, "Given the core meaning of *give* (which could be fairly specific), what meaning is the word *give* likely to have in this context?" Essentially, such rules would be principles of metaphor.

Such rules are not inconceivable. Take for example the meaning of *high* in *high mountains, high prices, high morale,* and *high opinion*. The intersection of the meanings of *high* in these various contexts is presumably something very general, something like "positive polarity," which would not be sufficient to distinguish *high* from other positive polarity words like *large, great, tall,* or *good*, especially since others of these presumably would also need very vague core meanings, if core meanings were defined simply in terms of the features common to all uses. However, one could also account for the meanings of *high* in the phrases mentioned by giving it a fairly concrete literal definition (for example, "positive polarity with respect to the vertical dimension"), and then stipulate a principle of semantic extension that says something like this: When terms having positive or negative polarity do not literally fit their contexts, preserve their polarity and adjust the scale on which the polarity is expressed to fit the context.

In the case of *give a kiss*, it is a little harder to state the principle explicitly, but the point is the same. Given some core meaning of *give*, which could be fairly specific, someone who knew anything about kissing, but had never heard the phrase *give (someone) a kiss*, could easily figure out what *give* means in this context using principles of metaphorical extension.

The notion of core meaning plus metaphorical extension fits awkwardly with the standard model, however. Logically speaking, within the standard model it would be expected that a meaning derived by metaphorical extension would be based on criterial features, since these features *are* the core meaning of the word in this model. However, as a matter of fact, metaphorical extensions are typically based on noncriterial features. Birds are not free by definition; nor is craftiness a criterion for being a fox.

And of course, even where the idea of a core meaning plus metaphorical extension is highly plausible, this does not guarantee that a person does not also store contextual variants. For example, the use of the phrase *the White House* to refer to the executive branch of the U.S. government is part of a predictable pattern of metonymy (cf. the Kremlin, the Vatican, No. 10 Downing Street). But that does not mean that the extended meaning of *the White House* isn't lexicalized, that is, permanently stored in the person's lexicon.

The problem is not that the relationship between the meanings of words is so opaque; in fact, we have just considered the possibility that it is predictable, given the contexts. The specific evidence against the core meaning approach in case of *give*, for instance, has to do with distribution; the fact that you can *give* someone a shove, but not *grant* someone a shove, you can *give* a performance, but not *donate* one, at least not in the same sense.

One way to solve the problem is to include in the lexical entry, along with the core meaning, a specification of the contexts in which the word is used. For example, *give* (permission, kisses, performance, medical treatment, . . .); *grant* (permission, favors, . . .). This move to salvage a parsimonious "core meaning" model seems to work satisfactorily in a number of cases. And, some will believe that it is inherently more satisfying to account for the differences in usage of *give, grant,* and *donate* as conventionalized restrictions on their distribution, rather than in terms of subtle differences in meaning.

But representing the distribution of these meanings in the lexicon, however it is done, necessarily comprises the principles of abstractness and parsimony; exemplars of the uses of words are being incorporated into lexical entries. In terms of the overall parsimony of the model, there is a trade-off

between specifying distribution, or postulating subtle distinctions in sense. If you are allowed to specify the contexts in which the word occurs, you can often get by with a vaguer, more generic account of its meaning. Conversely, more precise formulation of related meanings of a word will, at least in some cases, account for the word's distribution in the language. Which way is most parsimonious is not clear a priori. Nor is it apparent that the two alternatives--having separate senses of *give* for *give a kiss* and *give a recital*, or having one sense, but listing the specific contexts in which this one sense may occur--are any more than notational variants.

However, some facts about English usage appear to require including information about contexts in the mental lexicon. For example, the fact that in German you can have *high punishment (hohe Strafe)*, while in English punishment would be called severe, does not seem to be a fact about the meanings of the words *high* and *punishment* in English and German, but simply arbitrary facts about stock phrases in the two languages that must be recorded in the lexicon, if people are to use the words appropriately. Similarly, sometimes contextual information must be included in lexical entries for syntactic reasons. For example, it must be represented in the lexicon that *donate*, unlike the related verb *give*, cannot take an indirect object without a preposition; one doesn't normally say *He donated the museum a large sum of money.*

Not even the compromised model, in which the contexts in which a word is used are specified along with a core meaning, saves the standard theory from the embarrassment of multiple related senses. Often two or more senses must be postulated, because a word can have different meanings in identical contexts. For example, the sentence *The doctor delivered the baby* is potentially ambiguous, since this sentence could be used to refer to a situation in which the doctor brought the baby to a house in his station wagon.

In summary, we argue that it is typical of natural language that there are arbitrary, conventional restrictions on how words are combined in sentences; our knowledge of words must therefore include exemplars of their usage, in some form or another. The fact that words have multiple, contextually-contingent meanings is an anomaly for the standard model. Moves to account for contextual variation in meaning within the standard model are at best partially successful.

On the other hand, family-resemblance relationships among meanings are the natural consequence of a model of meaning in which the meaning of words is represented, not in terms of a maximally abstract generalization that covers all members of the set, but in terms of specific uses of the word. That is, for example, the application of a word like *game* to a new activity, say knocking bottles off a fence by throwing rocks at them, may be based, not on a consideration of whether that activity meets some general criteria for games, but on the basis of its similarity, say, to bowling.

Semantic Decomposition

In the standard model of word meaning, the connotation of a word consists of the set of necessary and sufficient conditions required for the serious, literal use of the word. Thus, the standard model of meaning presupposes some type of semantic decomposition, the analysis of meanings into conditions, or semantic features. We intend *semantic feature* to be an unproblematical and theoretically neutral term, although of course the expression has taken on a patina of meaning because of the way it has been used by various theorists.

A well-known example of feature analysis is the decomposition of *bachelor* into HUMAN, ADULT, MALE, NEVER MARRIED (Katz & Fodor, 1963). The features are capitalized (or marked in some other way such as <human> <adult>) to indicate these are conceptual distinctions instead of just other words in English.

Any attempt to analyze word senses into component distinctions, however modest and informal, could be called semantic feature analysis. Some type of semantic decomposition is almost unavoidable in the description of word meanings. That is, it would be difficult to deny that the meanings of some words overlap. One could hardly deny that some concepts are complex, and therefore reducible to simpler concepts. Nor could one deny that there are groups of words that share common elements of meaning. For example, one would scarcely want to argue that people have multiple, totally independent theories

of gender, one for the word *mother*, one for the word *uncle*, one for the word *niece*, one for the word *grandfather*, and so on.

However, the assertion that some words share semantic content does not amount to a theory of semantic features. Any theory of semantic features necessarily involves stronger claims. A feature theory strong enough to be interesting will have at least several of the following properties:

Criterial: Word meanings can be characterized in terms of a set of necessary and sufficient components.

Atomic: Semantic features are not further reducible within the linguistic system.

Sense based: Features can be defined in terms of sensory/motor constructs.

Binary: Features have two, mutually exclusive and opposite values.

Unstructured: Word meanings can be described in terms of unstructured or unordered sets of features, for example, a bachelor is someone who is human, and adult, and male, and unmarried.

Exhaustive: All word meanings in a language can be analyzed exhaustively into semantic components.

Parsimonious: The set of semantic features necessary to describe the vocabulary of a language is small, at the very least smaller than the number of the words in the language.

Universal: All word meanings in every language can be mapped onto a single universal alphabet of semantic features.

Sufficient to account for sentence semantics: Notions of sentence semantics such as synonymy, analyticity, ambiguity, meaningfulness, and anomaly can be adequately characterized in terms of semantic features.

Causally involved in comprehension: Word meanings are understood by decomposing them into their semantic features.

Convergent: The elements of meaning that are primitive in a description of adult linguistic knowledge will also be developmentally primitive, and also computationally primitive, that is the units of on-line comprehension.

Although it is often extremely convenient to talk in terms of components or features when discussing word meanings, one does not have a theory of semantic features at all unless one can maintain at least some of these properties. And strong objections have been raised to any theory of semantic features defined with enough precision to have any teeth; each of the above properties can be shown to be problematic.

Can Semantic Features Capture Necessary and Sufficient Conditions?

In the strongest versions of standard semantic theory, the goal is to specify the semantic features that are individually necessary and jointly sufficient for the sober, good faith use of a term. As we have already said, this goal has turned out to be impossible in principle for natural kind terms (Putnam, 1975), and perhaps inappropriate for other sorts of words as well (Green, 1984).

There are some words that may be considered to have truly necessary features. It does seem, for example, that a person's being unmarried is a necessary condition for literally calling this person a *bachelor*. However, this fact does not force one to the conclusion that even the meanings of these words can be described in terms of necessary and sufficient conditions. Continuing the example, the meaning of *bachelor* is influenced by a complex social milieu that is changing before our very eyes. The boundaries of its meaning are fuzzy and constantly shifting. Does a man become a bachelor if he remains unmarried past his twenty-first birthday? Or, not until his thirtieth? Does a young man have to move out of his parents' home to be called a bachelor? Can a divorced man properly be called a

bachelor? Is a man in a "long-term relationship" with a woman a bachelor? Is a man in a gay "marriage" a bachelor? Is a middle-aged woman who has never been married a bachelor? Has the meaning of the term shifted so that one now has to say *confirmed bachelor* to get across what was once communicated by *bachelor* alone?

Are Semantic Features Atomic and Sense-Based?

A feature is atomic, or primitive, if it is not further reducible. A feature is sense-based if its presence or absence can be directly determined using the eyes, ears, nose, or finger tips. Looking again at the representation of the meaning of bachelor as a string of features, MALE is perhaps sense-based, but it seems to be a bundle of separable characteristics rather than one irreducible feature. Obviously, NEVER MARRIED fails on both counts. It would be impossible to tell from looking at a man whether he had ever been married. Marriage is a complex social form that should be reducible to more primitive elements. NEVER is a peculiar, or at least special, modifier; yet the simpler NOT doesn't quite work, because a man who is divorced or a widower is not (usually) called a bachelor. *Bachelor* is not an exceptional case. Few of the semantic features that appear in published analyses appear to be both atomic and sense-based.

Are Semantic Features Binary?

Semantic features are usually treated as binary. It is customary to indicate that a word has a feature with a plus sign and that it does not have a feature with a minus sign. Words coded plus on a feature usually denote the presence of some attribute, those coded minus denote the absence or relative absence of the attribute. When pairs of words with contrasting values on a feature are examined, the ones coded plus usually are linguistically "unmarked" whereas the ones coded minus may be "marked." A word is "marked" if it contains a prefix, typically one indicating negation such as *un-* or *in-*; for example, *friendly* and *unfriendly, animate* and *inanimate*, and *relevant* and *irrelevant*. When a word coded plus and a word coded minus on a feature are used in a compound expression, the preferred order is the plus word before the minus word; thus, we say *good or bad* instead of *bad or good* and *husband and wife* instead of *wife and husband*.

The tradition of representing meanings as strings of binary, or two-valued features coded plus or minus lays traps for the unwary. VERTICAL seems to be atomic, sense-based, and universal. What +VERTICAL means is intuitively clear. Putting it in words it means, roughly, perpendicular to the plane of the earth's surface. However, there is an indefinite range of possibilities for -VERTICAL. It decidedly does not mean horizontal. Nor does -BLACK mean white, since many shades of gray are possible.

In general, a determinate meaning for a word coded minus on a feature is warranted only when the feature divides the world into two mutually exclusive and exhaustive categories. Thus, strictly speaking, TRUE cannot be equated with false, because statements may be partly true, answers not entirely wrong, and so on. Yet, stipulating that true and false are to be taken as mutually exclusive and exhaustive is a simplifying assumption that powerfully aids reasoning. Similarly, it can be argued that equating -MALE with female is a serviceable approximation to reality, despite the existence of bisexuals, transvestites, and hermaphrodites.

Some scholars have modified semantic feature theory by treating some semantic features essentially as continuous variables (e.g., Labov, 1973; Lakoff, 1972). Although allowing features to apply to varying degrees may appear to be a relatively minor extension of the notion "semantic feature," this extension in fact impacts on the notion of criteriality of features, which is at the very core of the standard model of word meaning.

Can Word Meanings be Described as Unordered Sets of Features?

The simple versions of feature theory assume that word meanings are unordered sets of features. However, it is easy to show that some sort of internal structure is needed to represent many word meanings. An example is *husband*. To say that this word is coded +ADULT and +MALE is merely to express boundary conditions; the distinctive semantic content is that a husband is the *spouse* of some

woman and, reciprocally, that this woman is his *spouse*. Just writing down SPOUSE doesn't reveal who is related to whom, and what characteristics they must have to enter into the relationship.

Various methods have been proposed for representing the internal structure of word senses. One is in "meaning postulates" (Carnap, 1947; Gordon & Lakoff, 1971), which attempt to formalize meanings in logical notation. Another way is in terms of "case structures." This approach was used by Fillmore (1968) in an informative analysis of verbs of judging, such as *accuse, blame, criticize,* and *praise*. Each of the capitalized words in the following represents a case or role. Verbs of judging involve a Situation, which is an action, deed, or state of affairs, that may impact favorably or unfavorably upon the Affected. The Situation may have been caused by a Defendant. A Judge renders a moral judgment about the Situation or the Defendant's responsibility. To illustrate, Fillmore gave the role structure of *accuse* as: A Judge tells an Addressee that a Defendant is responsible for a bad Situation.

According to Fillmore, a role is a variable to be assigned a value--or a slot to be instantiated--based on information from utterances being interpreted. For example, in the sentence *Sara accused Rick of leaving the gift*, the Judge is Sara and the Defendant is Rick. The Addressee is not clear; perhaps this role is also filled by Rick. Though leaving a gift is not ordinarily bad, it must fill the bad Situation role; otherwise, the sentence will not make sense. This leads to the further inferences; Sara is accusing in a playful manner, the gift is something outrageous, or Rick left the gift someplace where it should not have been left (e.g., at home instead of bringing it to a birthday party). Fillmore is making the same point frequently made by schema theorists: People strive for coherence; they fill slots with the information given when possible, by inference when necessary.

The point here is that there are groups of words--such as *buy* and *sell*, or *accuse, blame,* and *criticize*--whose meanings differ not in which features they contain, but in the structure into which these features are organized.

Can Semantic Features be Both Exhaustive and Parsimonious?

Can a set of features be constructed which both exhaustively describes the vocabulary of a language, and which is substantially smaller than that vocabulary? Analysis of the words in a language into semantic features is a reasonable enterprise only if the number of semantic features turns out to be smaller than the number of words they describe (Fodor et al., 1980). Knowing whether this is the case depends on an exhaustive and detailed semantic analysis of at least one language, something that is unlikely to be available in the foreseeable future.

There is a reason to doubt that semantic feature analysis will result in a vocabulary of features considerably smaller than the vocabulary of words. Having a relatively small number of features depends on the features required to make distinctions in any one semantic domain applying in several other domains.

For example, an absolute minimum of eight semantic features would be necessary to describe the meanings of *swagger, strut, stride, saunter, pace, amble,* and *stroll*--one feature, at least, for what they share, and at least one feature each that distinguishes them from the others. This semantic feature analysis will result in a set of features smaller than the vocabulary it describes only if these features are used elsewhere. For example, if there were an adverb for each of these verbs that exactly captures how the verb differs from the base verb *walk* (i.e., if the word *arrogantly* expresses exactly that which distinguishes *swagger* from *walk, vigorously* that which distinguishes *stride* from *walk*, etc.), then there would be 14 words (not counting *walk*), and only eight features.

Whether analysis of meanings into semantic features would actually result in such economy depends on two things. First, there is the question of whether or not one is satisfied with definitions such as "walk arrogantly" for *swagger*. Similarly, one can argue that *bachelor* means more than "unmarried adult male." One can add features such as "eligible" in the attempt to capture the subtleties of word sense that simple clusters of features do not capture, but this diminishes the chances that the number of semantic features postulated will be smaller than the number of words.

Second, there is the question whether the fine-grained distinctions necessary in any given domain will be applicable in any other domain. For example, the semantic difference between *roller skate* and *skateboard*, whatever it is, is not likely to play a role in very many other semantic domains. One could even go through the labor of trying to specify the semantic feature, perhaps INDIVIDUATED FOR SYMMETRICAL BODY PARTS, and trying to find other pairs of words that seem to be distinguished in terms of the feature, for instance, *mittens* versus *muffs, culottes* versus *skirts*, and, maybe, *skis* versus *toboggans*. Still, this leaves unvitiated the force of the argument that there will be an unmanageably large number of extremely specialized features if one tries to account for all of the fine distinctions in the vocabulary of a language.

One way to try to get around this problem is to recognize two types of semantic features. An example of such a division is Katz and Fodor's (1963) distinction between semantic markers--features which occur in many word meanings--and distinguishers, the semantic content unique to the word, that cannot be further analyzed into features that recur in other meanings.

It should be noted first of all that such a move involves abandoning several of the properties often postulated for a theory of semantic features. Taken together, semantic markers and distinguishers are no longer necessarily fewer in number than the words in the vocabulary of the language they describe. But semantic markers alone do not exhaustively describe the meanings of words. On the other hand, there may be a little more hope for having semantic markers (but not distinguishers) meet some of the other conditions postulated for semantic features, for instance, being atomic and universal.

Katz and Fodor had set as the basic goals of their theory accounting for the sentence-level semantic phenomena of ambiguity, analyticity, meaningfulness, anomaly, and synonymy. They had attempted to constrain their semantic theory by claiming that these phenomena could be described in terms of semantic markers, with no reference to the information in distinguishers. Bolinger (1965) argued cogently that this claim could not be maintained, effectively putting an end to the use of this distinction.

Are Semantic Features Universal?

Some semantic features, such as CAUSE, recur in the descriptions of numerous languages, reflecting, presumably, either innate properties of human cognition, or universal properties of human experience. While it is reasonable to suppose that *some* features are universal, any strong claim of universality of features would be incompatible with the criterion of exhaustiveness.

A strong test of universality would be to show that there is no semantic distinction between two words in any one language that cannot be expressed in terms of features independently motivated for many other languages. To carry out such a test for even a single semantic distinction in a well-researched domain, such as, for instance, kinship terms, would be a daunting task.

Are Semantic Features Sufficient to Account for Sentence Semantics?

In addition to providing a gloss on the meanings of individual words and furnishing the differentia for sets of related words, features are invoked to explain a variety of other aspects of meaning and language understanding. According to Katz and his associates (Katz, 1979; Katz & Fodor, 1963; Katz & Postal, 1964), whose seminal writings can be credited with the surge of interest in semantic feature analysis beginning in the mid 1960s, features play a pivotal role in resolving such matters as whether sentences are ambiguous, anomalous, or tautological.

The treatment of anomaly is illustrated by the sentence *The dream was tall.* It doesn't make sense, because dreams are not the sorts of things that can be tall. According to the theory, the problem is that *dream* does not have the feature + PHYSICAL OBJECT, which is required for the use of *tall.* It is the violation of this so-called "selection restriction" that is said to make the sentence anomalous.

The comprehensiveness of the feature theory proposed by Katz and his associates makes it very appealing and, at one and the same time, opens it to telling criticism. It can be argued that the theory sweeps under its skirts issues that can't be, or shouldn't be, decided solely on the basis of knowledge of the language. Feature theory glosses the sentence *She is the father of her children* as anomalous because

father is marked +MALE whereas *she* and *her* are marked -MALE. The sentence expresses a riddle to be sure, but the difficulty is not in understanding the assertion. Instead, the obstacle to comprehension is conceiving a situation in which the sentence could be a good faith utterance. A mundane possibility is a single woman who has to rough house with her sons, teach them to play ball, and so on. Matched to the scenario *father* is being used metaphorically. With just a little more imagination it is possible to envision a setting for the sentence in which *father* has a literal meaning: Suppose a transvestite with a family has a sex change operation (see Lyons, 1977, p. 305).

Are Semantic Features Causally Involved in Comprehension?

The weakest claim that could be made for some sort of semantic feature theory as a model of meaning is that of what Chomsky (1965) would call "observational adequacy." That is, the semantic features are hypothetical constructs that attempt to describe the content, although not necessarily the form, of people's knowledge of word meanings.

For example, at this level, saying that words such as *brother, uncle,* and *bachelor* have the feature +MALE is simply an assertion that anyone who knows what these words mean applies them (seriously and literally, at least) only to male individuals.

A stronger claim about semantic features can be made, namely, that they describe not only the content of people's word knowledge, but also the form it takes. From this perspective, features are psychologically real. A person who knows what the word means has this meaning represented in his or her mind as a set of semantic primitives.

This stronger claim, that the componential representation of word meaning is somehow isomorphic to the cognitive representation and processes involved in knowing and understanding words, gives rise to specific predictions about language processing--for instance, that speed and difficulty of processing should be predictable from the number and nature of semantic features involved in a word's meaning. Despite numerous experiments, unequivocal support for any strong version of this claim has not been found (Fodor et al., 1980; Kintsch, 1974).

Are Semantic Features Convergent?

Can there be a convergent theory of semantic features? That is, can one postulate a single set of features which are developmentally primitive (features which are acquired early, and out of which later meanings are constructed), computationally primitive (the elements involved in on-line comprehension), and definitionally primitive (the set of features out of which all meanings in adult language can be constructed)?

Carey (1982) points out that the classical view of semantic features assumes this kind of convergence (p. 351). As we have just argued, there is no evidence that semantic features are computationally primitive at all. Carey argues further that the features which would best describe distinctions among adult word meanings are not likely to be developmentally primitive (p. 367). Some of the distinctions among word meanings known by adults can only be described in terms of theories of the world which the young child does not yet posses. Hence, it does not seem possible for the same set of features to underlie children's acquisition of word meanings and adults' use of them.

Semantic Features As Lexical Organizers

Our discussion of what is known about semantic features left us with something of a paradox. On the one hand, some notion of semantic decomposition is almost unavoidable in any discussion of word meanings. As we said, it is hard to believe (by way of example) that a speaker of English would have separate, independent theories of gender for each term in the language that involved specification of a person being male or female. In other words, such terms must share common semantic elements. On the other hand, as we argued, any of the specific claims for a theory of semantic features that would be strong enough to have some teeth to it is problematical.

One step toward resolving this paradox is to attribute a more limited role to semantic features in the internal representation of word meanings. Semantic features can be treated as generalizations about the overlap in meaning among words. In this treatment, knowledge of the meaning of individual words is not necessarily embodied in features. An implication is that children initially could learn to use words such as father, mother, sister, and brother correctly without fully recognizing the semantic relationships among them. Only later would they come to understand the features that structure kinship terms.

Several researchers in the area of child language acquisition have suggested essentially this position. For example, Nelson (in press), after reviewing a range of language development research, says

> All of these findings suggest a system that is at first characterized by independent lexemes, that are related to experientially-based concepts but are not related directly to other lexemes, subsequently becoming reorganized in terms of relations between lexical items, a process that in turn leads to new insights into both the linguistic and the conceptual systems.

Nelson (in press) goes on to describe language acquisition in terms of three phases. "The third period is one of revision, re-organization and consolidation of lexical items within domains of related words."

Similarly, Gleitman and Wanner (1982), summarizing research on the acquisition of word meanings, say that "each early word is an unopened package; only much later does productive lexical analysis begin to appear" (p. 12). Gleitman and Wanner's point applies most obviously to the internal morphological structure of words. That is, children may learn the word *Thanksgiving*, and use it with some degree of appropriateness, before they appreciate that it has anything to do with giving thanks. However, the point applies equally well to the internal semantic structure of words. Bowerman (1982) gives specific cases of children learning to appropriately use semantically complex words like *drop* and *break*, which involve the notion of causation. But only later do they show, through overextensions in their use of other words, that they have recognized that the feature CAUSE has recurrent organizational significance in the English lexicon.

One way in which this perspective on semantic features differs from a stronger theory is that it abandons the claim of exhaustiveness. That is, it does not assume that words can be exhaustively analyzed into semantic features. Rather, the point is that *some* parts of word meanings may be factored out, so to speak. Bowerman (1982) theorizes that distinctions which have recurrent organizational significance may function differently from those that do not. "Meaning distinctions that are relevant only to one or a small handful of language forms may typically be left implicit, even if the child might in some sense recognize them.... In contrast, meaning distinctions that run systematically through a variety of forms ... may be pulled out for special attention under certain circumstances."

The point is that there are good reasons to distinguish conceptual distinctions a child is able to make from the subset of those distinctions that come to play a role in the organization of the child's word knowledge. Carey (1978) explains this in the following way:

> The child already knows the words *big* and *little* before he learns any of the specialized spatial adjectives. Since the core comparative structure (including polarity) is part of his early representations of *big* and *little*, these features are already available as lexical organizers when the child encounters a word like *wide* or *low*. By "available as a lexical organizer," I mean already part of the lexical entry of some word. Although the features underlying the dimensionality of spatial extent are part of the child's conceptual system, their linguistic relevance might not yet be recognized. That is, the child might not yet realize that the spatial concepts mark contrasts between words.... It is not unreasonable to assume that features available as lexical organizers are mapped onto new words more easily than those that are not yet available. (pp. 281-282)

A key assumption is that recognition of the semantic relationships among words, and hence of those parts of word meanings that are shared, is not a prerequisite for appropriate use of words and some level of understanding of them. As Gleitman and Wanner (1982) put it, "internal analysis of the word unit is a late and variable step in cognitive-linguistic development" (p. 13). Explicit representation of semantic relationships may be an asymptote that adults approach, rather than a characteristic of linguistic representation at all ages. Thus, Carey (1978) hypothesizes:

> It is possible that even some adults do not discover all the regularities in the domain, never fully representing, for example, how *fat, wide,* and *thick* differ, although they know very well some paradigm cases of things that can be each. (p. 28)

In the perspective being outlined here, then, semantic features are in some sense optional. People can, and often do, use and understand words correctly without recognition of the relationships that hold among them. If this is so, one can then justifiably ask, what function do semantic features have? An answer is that a knowledge of features facilitates word learning. In Carey's (1978, 1982) research, for instance, learning a new color word was easier if the construct of a color word was already part of a child's semantic system. Similarly, learning the word *niece* should be easier if one already knows that gender plays a systematic role in differentiating kinship terms.

If analysis of meanings into semantic features is optional, but aids in word learning, one might expect the tendency to recognize semantic features to be associated with greater facility in word learning. Van Daalen Kapteijns and Elshout-Mohr (1981, 1987) argue that the tendency to analyze word meanings into components is associated with higher verbal ability. They make this claim on the basis of their analysis of protocols from a task in which subjects had to infer the meaning of a novel word from a series of context sentences. The task paralleled the one used by Werner and Kaplan (1952), except that in this experiment, the novel words represented novel, complex concepts. In trying to integrate information from succeeding sentences, the higher ability subjects treated their initial hypothesis about the word's meaning as a decomposable structure, adjusting the meaning to fit other contexts by keeping some parts constant and varying others. The lower ability subjects, on the other hand, tended to treat word meanings as unanalyzable wholes; if the meaning they chose for the first sentence didn't fit the second, they would start from scratch rather than trying to alter parts of their first hypothesis.

In this section, we have outlined an alternative perspective on semantic features. Semantic features are theorized to represent, not essential conditions for comprehension and successful use of words, but attributes useful for organizing knowledge of word meanings. The evidence cited in this section is consistent with the position that we outlined earlier about the role of abstractness and parsimony in lexical representations: We do not deny that people see similarities among word meanings, and represent generalizations about these similarities in some way. What we deny is that word meanings are represented exclusively, or even primarily, at the maximal level of abstractness.

Sentence Meaning

Associated with the standard model of word meaning is the view that sentences have a literal, compositional meaning independent of world knowledge, context, or speaker's intentions. That is to say, the standard position is that the meaning of a sentence is determined by core word meanings, syntactic rules, and nothing else. We will attack this view in two ways: First, we will argue that for a large number of English sentences, the literal sentence meaning is not a compositional function of the meanings of the component words. Second, we will argue that the concept of literal meaning itself is not tenable.

Sentence Compositionality

One of the fundamental insights of generative grammar was the creativity of normal language use. As has been pointed out repeatedly by Chomsky (1965) and others, knowing English (or any other language) does not consist in knowing a list of specific sentences. Rather, the rules of syntax can be applied creatively, so that many of the sentences one speaks or hears, although fully understandable, are occurring for the first time in the history of the language. This is no doubt true, for example, of the vast majority of the sentences in this report to the extent that the reader understands them, it is not because these exact sentences have been read or heard before.

We do not deny that understanding and producing English involves creative use of the syntactic rules of the language. However, the fact that language use is *truly* creative does not mean that it is *fully* creative. Although the grammar of a language must specify how words are put together to form sentences, it does not follow that when speakers or writers form sentences, they start from the smallest

units, building phrases from individual words, and sentences from phrases. On the contrary, the frequency of idioms, collocations, cliches, and stock phrases in normal language use shows that normal speech is often more like baking a cake from a mix than like baking a cake from scratch.

Normal language use is full of prefabricated units. Such units, since they function as units, tend to take on meanings above and beyond what is predictable from the meanings of their component parts. This is most obvious at the level of words. The fact that an iceman brings the ice, but a snowman is made out of snow, for example, cannot be determined on the basis of the meanings of *ice, snow,* and *man* alone. It would be safe to say that a large proportion of the complex words in the language, and the majority of the most frequent ones, have meanings that convey something beyond what is predictable on the basis of the meanings of the parts alone. however, there is also rampant semantic irregularity above the level of the word. The idiosyncrasy of the meaning of a phrase is sometimes minor; the fact that one says *ham and eggs* instead of *eggs and ham* may encode only the fact that ham and eggs is a traditional combination of foods, unlike, for example, eggs and broccoli. But there is a continuum of semantic irregularity, ranging from phrases like *ham and eggs* to fully opaque expressions like *kick the bucket*, or *by and large*.

In between are a variety of fixed phrases like *flew the coop, change one's mind, toe the line, make ends meet, pay one's own way, make oneself at home,* or *to think better of something.* In some sense, the in-between cases are the most problematic for a compositional model of sentence meaning. On the one hand, the meaning of the phrase is more than, or different from, the sum of its parts; on the other hand, it cannot be treated simply as a long word, because there is recognizable internal structure, and some of the items within these phrases do have their usual meanings. Furthermore, the number and frequency of this type of phrase in normal language use is far greater than most people are aware. *Take your chances* and *make yourself at home* may sound like examples of perfectly regular, literal phrases, until you realize that *take your risks* and *make yourself at house*, although presumably similar in meaning, don't sound like normal English.

For a substantial proportion of the phrases used in English, then, it is simply not possible to treat their meanings as a componential function of the meanings of their parts. Rather, the meaning of the phrase, or at least some aspects of its meanings, must be considered to be associated with the phrase as a whole. This raises the possibility that even for some of the phrases that have fully predictable meanings, the meaning of the phrase as a whole is also stored in memory, rather than being computed from scratch every time the phrase is used. Of course, for truly novel phrases, meanings will have to be computed. But there is little reason to cling to an a priori notion of parsimony that would necessitate, for a phrase with a perfectly regular meaning, that the listener compute its meaning afresh on the fifth, tenth, or hundredth time he or she heard it.

Indirect speech acts also pose a problem for the concept of literal sentence meaning. The sentence *Can you pass the salt?* literally asks whether someone is able to pass the salt, but what it actually means is please pass the salt. A somewhat similar problem is posed by idioms. The sentence *He kicked the bucket* literally declares that someone struck a blow with his foot against a type of container, but what it ordinarily means is that someone died.

The way proponents of compositional theory propose to deal with indirect speech acts and idioms is to distinguish between *sentence meaning* and *utterance meaning.* Utterance meaning is so called because the sentence is supposed to have been uttered by some speaker in some situation for some reason. Thus, *Do you have change for a dollar?* is a question at the level of sentence meaning but usually is a request at the level of utterance meaning. Sentence meaning is supposed to be the unadorned linguistic interpretation, while utterance meaning includes elaborations based on linguistic context, situational context, and background knowledge. The distinction between literal sentence meaning and utterance meaning parallels the distinction between *core word meaning* (connotation) and *contextual word meaning* (sense) we discussed in an earlier section.

In compositional theories of language processing, it is supposed that people first compute sentence meaning and then ascertain utterance meaning. It follows that it should take longer to understand sentences containing expressions like *kick the bucket* when the expressions are used idiomatically than when they are used literally. The reasoning is that it will take time to activate and then reject the literal

meaning which, in expressions such as this, is misaligned with utterance meaning. Gibbs (1986) was unable to confirm this prediction. Nor did he find that it took people longer to process sentences such as *Can you pass the salt?* in contexts that invited an indirect speech act interpretation as compared with contexts that invited a literal interpretation (Gibbs, 1983).

One way to save compositional theory from the predictions that went unfulfilled in the Gibbs experiments is to assume that people treat familiar idioms and conventional indirect requests as long words. Accordingly, to die is one sense, undoubtedly the primary one, of the whole phrase, *kick the bucket*. There is evidence that all of the distinct senses of a word are activated when it is encountered and then the ones that don't fit the context quickly fade (Swinney, 1979). Thus, if such expressions are treated as long words, it may be possible to explain Gibbs' findings within the standard framework.

We are, of course, willing to accept the consequence that a large number of prefabricated sentences and sentence fragments will be stored in memory. However, the attempt to salvage a compositional theory of sentence processing by redefining idioms and indirect speech acts as complex words is somewhat self-defeating. That is, any apparently nonliteral utterance meaning which is not associated with an increase in processing time becomes a literal sentence meaning, by definition, and a noncompositional one, at that. This amounts to simply defining away any counterexamples to the claim of compositional theory that nonliteral meanings should require additional processing time.

Literal Sentence Meaning

Our fundamental quarrel is with the construct literal sentence meaning. Specifically, we reject the claim that there is a sentence meaning, constructed prior to and apart from the application of background knowledge to determine utterance meaning, which constitutes a literal understanding of the sentence.

First of all, we question whether there can be a strict ordering of types of processing, with background knowledge being called into play only after all strictly linguistic processing has been completed. Certainly there are *some* bottom-up processes in reading comprehension that operate prior to and independent of the reader's knowledge or expectations. For example, as we have mentioned, it appears that all distinct senses of a word are immediately activated, before contextual words with selection of sense takes place. But we know of no persuasive evidence that linguistically-based selection of senses--for example, distinguishing between the senses of *rose* on the basis of its syntactic function--always occurs before knowledge-based selection of senses. (For the contrasting view that lexical access is "impenetrable" to influence of world knowledge, see Perfetti & McCutchen, 1986).

Secondly, we claim that the ordinary experience of understanding a sentence corresponds to the concept of utterance meaning, and necessarily involves the utilization of world knowledge. There is no experience of sentence meaning that does not involve the application of background knowledge in some way. This can be illustrated by examples of several types.

Consider the following set of sentences, all containing what in any parsimonious version of the standard model would constitute the same sense of the verb *cut*:

Bill cut the grass.
The barber cut Tom's hair.
Sally cut the cake.

A normal reading of these sentences produces envisionments, or scenarios, that go beyond what might be said to be literally contained in the words. Everyone's envisionments will include the instruments by which the cutting is done. The word *cut* is used in the same sense in these sentences, meaning roughly to physically separate into parts using a more or less sharp object.

Yet as Searle (1979) has observed, "crazy misunderstandings" will be likely if that is all there is to the meaning of *cut* in these sentences: Sally's cutting the cake with a lawn mower would be no less acceptable than her using a knife. In other words, a person asked to determine the literal meaning of

the sentence *Sally cut the cake* would not have in mind an abstract representation of the situation which was equally applicable to cutting the cake with a lawn mower and with a knife.

It is true that, with some conscious effort, a person can imagine a representation of the "meaning" of the sentence *Sally cut the cake* that is so abstract as to apply equally well to either of these situations. It seems peculiar, though, to cling to the position that the result of such mental gymnastics has more right to be called the meaning of the sentence than what comes spontaneously to the mind of the normal reader taking the sentence at face value.

It might appear that the problem posed for the concept of literal meaning by the preceding example could be dealt with simply by postulating multiple senses of the word *cut*. If there are three senses of *cut*, something like "to mow, as with a lawn mower," "to trim, as with scissors," and "to separate into serving portions," then one might be able to equate literal meaning with the normal understanding of these sentences. However, such a move would ultimately require an appeal to background knowledge in the disambiguation of *cut*, as we explained at length in our discussion of contextual variation in the standard model.

Another type of example involves sentences which are not fully comprehensible unless one is able to bring to bear extra-linguistic knowledge. In this example, unlike the preceding one, distinctions in the sense of individual words do not play a crucial role. Try to determine the literal meaning of the following sentences:

The haystack was important because the cloth ripped.
The notes were sour because the seams split.
The party stalled because the wire straightened.

These sentences are well known to psycholinguists from the work of Bransford and Franks (1976), but if you have not seen them before you probably experienced difficulty in coming up with anything you would want to call the sentence meaning. To be sure, these are especially contrived sentences. But they are not defective like *Colorless green ideas sleep furiously*. The syntax is straightforward. The words are used in ordinary ways. And, each of the sentences does have a legitimate and readily understandable interpretation.

Now, consider some clues that provide additional information for interpreting the sentences. The clues are *parachute, bagpipe,* and *corkscrew* for the three sentences, respectively. If any of the clues enabled the "click of comprehension" for you, the source of difficulty with the sentences ought to be clear: The obstacle to comprehension is envisioning possible situations onto which the sentences could map. The question is whether, if you failed to come up with the defective parachute envisionment, for instance, you would want to say that you were in possession of the meaning of the haystack sentence? We believe the answer is no, but not everyone agrees.

Let us sharpen the issue. The question is whether sentences have a "zero-context," literal meaning--that is, a meaning that does not depend in any way on analysis of the linguistic context, in any way on analysis of the situation, or in any way on world knowledge. The zero- or null-context meaning of a sentence is supposed to depend solely on its wording and syntax (and maybe other linguistic machinery, as long as no contextual analysis or world knowledge creeps in).

Our experience is that educators do not appreciate the force of weird counterexamples against what are presented as universal claims, because they so often have to deal with claims that no one in their right mind would mistake as being universal in scope. The sentences above about haystack and so on might be discounted because they are a little weird. We turn, therefore, to the exquisitely simple sentence below:

The cat is on the mat.

This sentence has been debated at length by Searle (1979), who upholds the constructivist position, and Katz (1981), who defends what we are calling the standard position. Katz claims to know the zero-context meaning of *The cat is on the mat*. He says,

> The sentence . . . has a literal compositional meaning. Unlike *Itches drink theorems*, its selection restrictions are in order. Its meaning is, roughly, that some (contextually specified) cat is vertically positioned over some (contextually specified) mat and that the aforementioned cat is also positioned so that its bottom is in contact with the top of the mat. (p. 220)

Katz completely gives away his argument in this passage. Bear in mind that he is not merely suggesting the usual meaning of the sentence, or pointing to one among several possible meanings. He is declaring the literal meaning based on the sentence's wording alone, with what he alleges is absolutely no reliance on context or world knowledge. Thus, to display a legitimate interpretation different from Katz's is to prove him wrong. And this is easily done. Katz says the sentence means the cat is vertically positioned over the mat, but consider the possibility that the mat is being used as a wall hanging and that the cat has jumped up and grabbed the mat with its claws. Katz says that the sentence means that the cat is also positioned so that it is in contact with the top of the mat, but imagine the possibility of a cat balancing on the edge of a rolled, stiff, upright mat standing in a corner. As for the cat, its bottom does not need to be in contact with the mat in order to satisfy the sentence; it could be standing or it could be lying on its side.

It is plain to see that what Katz hold up as the zero-context, literal meaning of this sentence depends heavily on assumptions about customary positions of mats and usual postures of cats. We assert as a general rule that the literal meaning of a sentence is parasitical on assumptions about normal states of the world. It follows that there is no such thing as a zero-context meaning for a sentence.

The idea of literal meaning as the first derivative in language understanding has had an almost irresistible appeal for information processing psychologists committed to the concept of automaticity. Basically they argue that a fast, fluent process could not involve much reasoning or complicated choices among alternatives. For a good exposition of this position, which goes over some of the same ground as this report, see Perfetti and McCutchen (1986).

For a different reason, the idea of literal meaning also has appeal to linguists. Consider the sentence *Flying planes can be dangerous.* It has two distinct meanings, at least in some sense of meaning, depending on whether one sees *planes* as the underlying subject or underlying object of *flying*. The concept of utterance meaning does not provide the right level of analysis for dealing insightfully with ambiguities of this type, however. But if linguists were to adopt a construct of literal sentence meaning for talking about such examples, they would have to (we argue) avoid identifying that construct with any actual representation of sentences by real listeners or readers.

We believe that both the assumption of fixed core meanings, which are automatically accessed, and the assumption of invariant parsing rules, which are automatically applied, are faulty, for the reasons set forth in the preceding sections. This is not to say that word senses do not get accessed or that sentences do not get parsed, and that these steps happen fairly early and fairly routinely during sentence interpretation. The mistake is to identify these transient linguistic throughputs with meaning.

Why Is The Standard Model So Attractive?

If the standard model of word meaning is wrong on so many counts, and if there is such a substantial consensus among scholars that it is inadequate, why is it so attractive?

One reason is that the standard model serves as an ideal for scientific terminology, or in fact, terminology in any domain in which communication is intended to be as explicit and precise as possible. In some sense, then, the standard model reflects what many scientists and philosophers wished the language were, and tried to make it. Watson and Olson (1987) argue that a standard model of meaning, in which words are defined in terms of criterial features, follows naturally from the need for communication in a modern, literate society to be successful without personal contact, when there is no guarantee of shared assumptions.

The standard model reflects the time when scholars, at least, still thought of language primarily as written language. It might have been acknowledged that word meanings in oral language were vague

and variable, but this was looked upon as exactly what good writers would want to avoid. There is, of course, a long tradition of a prescriptive approach towards language, treating the language not in terms of what it is, but in terms of a conception of what it should be. It is really only relatively recently that linguists have explicitly focused on oral, rather than written, language as primary. A prescriptive approach to language is still firmly entrenched in popular thinking, as can be seen from the nature of the debates about dictionaries, such as the one surrounding the publication of *Webster's Third.*

The Relationship Between Linguistic And Conceptual Categories

To some extent, the attractiveness of the standard model, and its failure, can be understood in terms of two different ways of thinking about the relationship between language and the world, or more precisely, between linguistic and conceptual categories.

One we could call the "grid" model. In this model, the relationship between word meanings and the world can be thought of as analogous to the imposition of national and state boundaries on a map of, say, North America. In this analogy, state boundaries represent word meanings, national boundaries represent superordinate categories, and the whole map represents the conceptual domain--say, the universe of all animals, or of all colors, or of all emotions.

Criteriality is a logical consequence of the grid model. It follows from the fact that the conceptual domain is exhaustively categorized. The label given to an entity identifies what category the entity is in, but not its position within that category.

An alternative way of thinking might be called the "scattered points" model. Word meanings are associated with points in a conceptual space in this model. To use another geographical metaphor, imagine a world in which almost all of the population lives in widely dispersed cities. Although the cities are clearly named, the lack of substantial population outside the cities has made it quite unnecessary, in most cases, to draw boundaries between them. There is a lot of territory that doesn't belong to any particular city. When an area near an established city is settled, the region is sometimes simply counted as part of the city, even though it may not be physically contiguous.

There is no reason to identify criterial features in the second model. There are a hundred ways one can differentiate Boston from New York; but there is no need to determine which of them uniquely identifies the essence of either city.

There are some cases of naming in which the grid model is better. For example, a biologist trying to come up with terms, say, at the mid levels of a biological taxonomy is essentially trying to impose a grid on a conceptual domain. The terms must be chosen so that they allow one to exhaustively categorize known animals. However, the taxonomy must not be so bound to idiosyncratic properties of individual species that the discovery of a new related species would necessitate major reorganization.

More generally, it could be said that the grid model is the standard for scientific terminology, especially at the level of superordinate terms. The scattered points model, on the other hand, deals more comfortably with basic level terms used in ordinary language: There is maximal similarity among members of a basic level category and maximal dissimilarity between members of this category and other categories (Rosch & Mervis, 1975).

The nature of the relationship between linguistic and cognitive categories has long been a matter of debate. Whorf (1956) is associated with a strong claim about this relationship, in which linguistic categories are seen as primary. According to what has come to be called the Sapir-Whorf hypothesis, it is claimed that languages can differ radically in the way that they categorize and structure the world, and that linguistic categories determine cognitive categories. Thus, the structure of one's language determines how one perceives and thinks about the world. In slightly different terms, the linguistic system is both an embodiment of the world-view of a culture, and a necessary and sufficient means of inculcating it in new members.

Part of the attractiveness of the Sapir-Whorf hypothesis was that it constituted an instantiation of the insight that existing knowledge structures have a profound effect on cognition and perception, one that

predated the most recent incarnation of schema theory. The distinctive element of the Sapir-Whorf hypothesis, however--the primacy of *linguistic* structure--has never met with wide acceptance.

But despite the fact that the Sapir-Whorf hypothesis has never achieved the status of a consensus opinion, there is reason to believe that some of the assumptions underlying this hypothesis have influenced thinking about word meanings, and in fact, constitute part of the foundation for the standard model of word meaning; in particular, the assumption that experience of the world is inherently unstructured or continuous, and that language plays a primary role in structuring and categorizing it. This idea motivated James' famous description of the infant's experience of the world as a "blooming, buzzing confusion." Thus, until Berlin and Kay's (1969) work, the rainbow was often taken as a metaphor of the relationship between language and the world. The physical reality is an undifferentiated continuum; it is language which imposes boundaries.

The grid metaphor, then, can be seen as flowing out of a way of looking at the relationship between language and the world. It is most appropriate in those instances in which word meanings do serve to exhaustively categorize some semantic domain--which is sometimes the case, especially for superordinate categories.

The grid metaphor, however, depends crucially on the assumption that experience is essentially undifferentiated, and that it is language which imposes structure. Recently, increasing evidence has been brought forward that in numerous domains, conceptual structure is independent of or prior to linguistic categories (see Au, 1988, for a review of such evidence). For example, in the domain of color, although physically a rainbow is a continuum of wavelengths, the human perceptual apparatus in fact defines certain focal colors as being perceptually salient. Linguistic systems differ in interesting ways in how they categorize colors, but within constraints reflecting the structure imposed by the human perceptual system (Berlin & Kay, 1969). Perceptually, the rainbow is not a continuum; and there is no reason to believe that people from different language groups see different rainbows.

Nelson (in press), Clark (1983), and others have suggested that the extremely rapid rate of early word growth is due to the fact that once children have figured out what naming is about, they already have a very rich conceptual structure, and lots of concepts to learn the names for. It may be relevant in this regard that Nagy, Anderson, and Herman (1987) found that, in learning new words incidentally while reading, school children learned words for which they already had concepts, but did not learn words which represented new concepts.

We are not arguing that the grid model *never* fits the relationship between linguistic and conceptual categories. There are domains, as we have indicated, such as biological taxonomies, where exhaustive categorization is an important function of language. However, we would argue that meanings are not *typically* structured into exhaustive and mutually exclusive categories arranged into taxonomic hierarchies.

Let's take for an example the average person's knowledge of names for tools. Do the tool names known by most people exhaustively categorize the universe of tools, or any subparts of that universe? Hardly. We can imagine, and we think we have seen, numerous tools which do not fit into any of our existing tool categories. Even for people with rich tool vocabularies, it seems likely that a new tool could be invented which would not be a special subcategory of existing tools.

For most people, if our experience is representative, the vocabulary of tool names contains a preponderance of basic level categories (e.g., *saw, hammer, drill*), with a few subcategories (*hacksaw, coping saw*), and few if any true superordinates. These terms in no way exhaustively categorize the universe of possible tools.

Does this example simply reflect a fact about tools--the fact that linguistic categories can't anticipate all possible technological breakthroughs? Let's take a different example, then, the set of verbs that describe human motion unaided by mechanical devices: verbs like *walk, run, skip, hop, dance, crawl,* etc. Do such verbs divide possible human motion into a taxonomic hierarchy of mutually exclusive and exhaustive categories?

Not without violence to the normal meanings of the words. Again, there appears to be a lack of true superordinates--for example, is there a label for the category that includes *walk* and *run*? The common category names do not exhaustively categorize the space of possible human movement. For example, a cartwheel does not seem to fit into any more general category, nor does to walk on one's hands.

The world is structured because there is a lot of empty space in it. There are few if any tools halfway between a saw and a screwdriver. A farm does not include a continuum of animals ranging from sheep to cows. People talk, and they sing, but in normal life in our culture they usually do one or the other; daily experience does not include a lot of things intermediate between the two.

To conclude, the scattered points metaphor provides a better picture than the grid metaphor of the relationships between words and thoughts and objects. Names for things in natural languages have redundant, noncriterial features because there is empty space between categories.

Definitions and Word Meaning

Almost all conventional vocabulary instruction involves definitions in some way. Students look up definitions, memorize them, select the appropriate one from several alternatives, or arrive at them through discussion. Indeed, it is hard to imagine explicit instruction about word meanings that does not either begin or end with some sort of statement or description of the meaning of the word being learned.

Vocabulary instruction generally involves definitions that reflect many of the characteristics of the standard model of word meaning. The very term *definition* implies criteriality, abstractness, and parsimony of statement. Very often, the definitions used in vocabulary instruction and in glossaries are even shorter, more abstract, and less likely to include examples and information about contextual constraints than those found in regular dictionaries. Especially in such cases, the theoretical weaknesses of the standard model translate into pedagogical shortcomings.

Definitions and Meanings

A fundamental fact to be accounted for by any theory of word meaning is that people are, for the most part, not able to articulate their knowledge of word meanings quickly or easily (Johnson-Laird, 1987). This fact implies that a distinction has to be made between knowledge of word meanings and knowledge of definitions.

The fact that word knowledge normally does not take the form of definitions is a matter of logical necessity in the last analysis. Definitions map words onto other words, and at some point this circularity must be broken (Fodor et al., 1980). Familiar words that have been learned from experience in context are especially difficult to define. When familiar, everyday words are cast in definitions, it must be in terms of much less familiar words (Johnson-Laird, 1987).

But even for those words that are more amenable to definition, the distinction between knowing the meaning of the word and knowing its definition must be maintained. For most words one knows, producing a definition requires a substantial amount of reflection, whereas understanding what the word means during reading takes about a quarter of a second (McConkie, Reddix, & Zola, 1985).

Knowing a definition is neither a necessary nor sufficient condition for knowing the meaning of a word. Children successfully understand and use many words before they have the linguistic or cognitive sophistication to either produce or understand any sort of formal definition (Watson, 1985). Even for adults, the task of producing a definition for a known word is not trivial.

Nor can the gap between knowing meanings and knowing definitions be attributed simply to problems in expressing oneself. When selecting the right alternative on a multiple choice vocabulary test or looking up a familiar word in the dictionary, one often has the sense that some insight was gained. Thus, one can know a word well enough, and still feel that one has learned something by seeing an explicit definition. This would not happen if the definition already constituted understanding of the word.

Not only is knowledge of a definition not a necessary condition for knowing the meaning of a word, it is not a sufficient one either. Miller and Gildea's (1987) examples of the sort of sentences children produce on the basis of definitions make the point forcefully. For instance, given the definition of *correlate* as "to be related one to the other," one child wrote, "Me and my parents correlate, because without them I wouldn't be here." That definitions are not sufficient for knowing the meanings of words is also forcefully illustrated by the widespread failure of definition-based instruction in word meanings to improve comprehension of text containing the instructed words (Graves, 1986; McKeown, Beck, Omanson & Pople, 1985; Mezynski, 1983; Stahl & Fairbanks, 1986).

Attributes of the Standard Model Reflected in Definitions

The chief pedagogical difficulties with definitions arise from the properties of parsimony and abstractness. These properties are a consequence both of the standard model of meaning, and of the nature of dictionaries. Dictionaries are designed as reference works, not as a teaching aids, and the practical consideration of length limits their informativeness.

The need to be brief pushes writers and editors of definitions to use very sophisticated and abstract language. Definitions are commonly shortened by using abstract nouns, which allows stating a predicate without specifying the arguments. For example, in a basal glossary, *habits* is defined as "usual behavior" rather than "what a person or animal usually does." Although the more abstract wording saves space, it diminishes the pedagogical usefulness of definitions. The linguistic devices used in definitions are not likely to be familiar to many younger and less-able learners, the very ones most likely to need help with word meanings.

Another problem is that a brief definition often simply does not contain sufficient information about a word. As we have argued earlier, any attempt to reduce the variety of contextual meanings of a word by stipulating a core meaning results in substantial loss of semantic content and precision. Unless illustrative sentences are included, definitions do not provide sufficient information about how a word is actually used. And comprehension is no respecter of the line between linguistic knowledge and general knowledge, wherever one draws that line. Understanding a text always depends on knowledge that goes beyond any narrow conception of word meanings.

Definitions and Instruction

Definitions--even short ones--can make a contribution to the process of word learning. Definitions can convey information that may not be available from the natural contexts in which a word appears. Thus, learning the definition for a word may serve as a foundation for making more effective use of subsequent encounters with that word in context, or help in organizing and synthesizing information gained form prior encounters.

However, real word knowledge is less abstract than the information provided in a definition, and includes representations of the contexts in which a word appears. This type of word knowledge can be inferred from a definition, but usually only if a sufficient number of illustrative contexts are also available to the learner. Studies such as those of McKeown et al. (1985) show that intensive vocabulary instruction, but not definitional instruction alone, improves text comprehension. These studies demonstrate that vocabulary instruction only produces gains in real uses of language when the students have engaged in activities that foster the translation of definitions into a working knowledge of meanings.

The process of arriving at definitions of words through, for instance, class discussion, though it can be time-consuming, is probably productive in the long run. One benefit is the insight students gain into the process of making explicit knowledge that has formerly been tacit. But, to reiterate, the ability to recognize or even state definitions is a symptom of word knowledge, not its essence.

In summary, although explanations of the meanings of words are certainly a part of vocabulary instruction, the conventions that constrain traditional definitions make them of limited pedagogical value. The information in definitions must be supplemented by experience with the words to be learned

in natural contexts. Teaching word meanings via definitions alone is analogous to trying to teach someone to cook by having them heat TV dinners.

Beyond Definitions: Treating Word Meanings as Complex, Ill-structured Knowledge

Much of this report has been devoted, in effect, to the point that to truly know the meaning of a word is to possess complex and ill-structured knowledge. According to Spiro and his colleagues (Spiro, Feltovich, & Coulson, in press; Spiro, Vispoel, Schmitz, Samarapungavan, & Boerger, 1987), one aspect of ill-structuredness is the contextual interaction of concepts. For example, the flow of blood in the circulatory system depends not just on the properties of the heart, and of the veins, and of the arteries, and of the capillaries; it depends on how these components fit together as a system. Likewise, the meaning of a sentence is not a simple compositional function of the core meanings of individual words.

A second aspect of ill-structuredness is irregularity. In an ill-structured domain, knowledge of the domain cannot be reduced to a single generalization or organizational scheme. The family-resemblance structure of related word meanings is exactly this kind of case.

Spiro, Coulson, Feltovich and Anderson (1988) argue that advanced knowledge acquisition in a complex and ill-structured domain requires viewing the domain from multiple perspectives, a case-based rather than an abstraction-based approach, and a commitment to avoiding oversimplification. Spiro and his colleagues have been concerned with, for example, the learning of biomedical concepts by medical students. However, we want to argue that their formulation is equally applicable to the learning and teaching of word meanings.

In the vocabulary instruction, multiple examples have proved desirable. The research literature shows that more effective learning is associated with multiple exposures to a word (Stahl & Fairbanks, 1986). Furthermore, in improving comprehension, multiple exposures involving varied contexts, rather than just multiple exposures to definitions, seem necessary (McKeown, Beck, Omanson & Pople, 1985).

Likewise, in vocabulary instruction there is much to be said for a case-based rather than abstraction-based approach. As we have already suggested, the widespread existence of family resemblance clusters of word meanings indicates that people extend word meanings to new cases on the basis of specific known cases, rather than on the basis of some more abstract and general representation. Pedagogically, this principle suggests that instead of definitions being seen as central, and illustrative examples of words in context as supplementary, the opposite ought to be the rule.

In vocabulary learning, as in medicine and the other fields Spiro and his associates have examined, oversimplification is an ever present danger, and it is a danger that often arises because of over-reliance on abstract generalizations. To borrow another example from Miller and Gildea (1987), given the definition of *meticulous* as "very careful or too particular about small details," a student apparently took the meaning to be "very careful," and wrote the sentence "I was meticulous about falling off the cliff."

The whole point of vocabulary learning is flexible application--"reasoning with, and applying, the material learned," in Spiro's phrase. Word meanings are learned to serve as tools for comprehension and new learning, not simply as facts to be remembered. The truth is that students are seldom called on to apply knowledge, say, of the Civil War, other than in answering test questions. Really knowing a word, on the other hand, always means being able to apply it flexibly but accurately in a range of new contexts and situations. Thus, it can be argued that there is no knowledge addressed in school in which application is more crucial than knowledge of word meanings. The challenge for educators is to provide instruction of the sort that will lead to flexible application of word knowledge.

Conclusion

What we have mainly done in this report is take a close look at the standard theory of word meanings. We have concluded that every element of the theory is open to serious challenge. No one has yet been able to specify a set of semantic features that are atomic, sense-based, and universal in application, that provide an exhaustive and satisfying analysis of word meanings, or that give a firm foundation for sentence semantics; nor is there good reason to hope that these goals are even achievable. In its very

attempt to provide a parsimonious, general account of semantics, standard theory falls woefully short of a linguistically adequate and psychologically realistic characterization of meaning.

There is general dissatisfaction with standard theory among semantic theorists. Yet this report is, we submit, more than an exercise in beating dead horses. Versions of the standard theory do have current-day proponents among scholars concerned with language, notably among information processing psychologists trying to account for the speed and fluency with which people process language. More important, considering the primary audience of this report, something resembling standard theory seems to characterize the conventional wisdom about word meanings in the field of reading education.

Standard semantic theory seems to provide the tacit foundation for several common practices in vocabulary instruction. To the extent that the foundation is weak, the practices may be of dubious value. We hope that exposing the assumptions of prevailing semantic theory to close scrutiny will make some contribution to raising the level of consciousness of the field, informing debate, refocusing research, and informing practice.

One instructional practice that is widespread is to preteach unfamiliar vocabulary before commencing a reading selection. The assumptions seem to be that (a) words have fixed, context-free meanings and (b) that the meaning of a text is a compositional function of the meanings of its constituent words. As we have argued at length, both of these assumptions are shaky. We believe that apprehending the gist of a story is as likely or even more likely to assist in learning the meanings of unfamiliar words than vice versa.

A second widespread practice is reliance on the definitions in dictionaries and glossaries as sources for the meanings of unfamiliar words. But if we are correct, and word meanings are context-sensitive, a dictionary is a questionable aid for an inexpert language learner. In fact, independent empirical evidence shows that dictionaries often fail to provide children with much help (Miller & Gildea, 1987).

Finally, there is the practice of attempting to promote vocabulary growth by providing direct instruction, drill, and practice on lists of isolated, unrelated words. In another line of research, we have established that the size of the vocabulary learning task is simply too large to make much headway teaching words 1 at a time, 10 at a time, or even a 100 at a time (Nagy & Anderson, 1984; Nagy, Anderson, & Herman, 1987; Nagy & Herman, 1987; Nagy, Herman, & Anderson, 1985). The theoretical analysis presented in this report provides independent, converging reasons for being suspicious about the value of instruction involving lists of isolated words: Word meanings are difficult to capture in the abstract; nuance of meaning, especially, depends upon setting and context.

The most obvious implication of our analysis is as follows: For enhancement of children's vocabulary growth and development, there can be no substitute for voluminous experience with rich, natural language.

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Authors' Note

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